CLAIMS

What is claimed is:

1. An elasto-plastic socket for a Land or Ball Grid Array (LGA/BGA) package comprising:

an insulative board having one or more matrices of housing openings and a plurality of holes proximate edges of the board;

a plurality of metal contacts fit in the housing openings on the board;

a laminate bonding layer applied on the board to fix the plurality of metal contacts; and

a plurality of alignment means such as pins or spring clips fit into the plurality of holes on the board for aligning the LGA/BGA package to the metal contacts.

2. The elasto-plastic socket of claim 1, wherein the metal contacts comprise a top surface portion for contact with package pads, a curved plate spring portion of different width connected to the top surface portion, a contact wall portion providing sliding contact with the plate spring and a PCB side contact portion, and wherein the metal contacts are plated with gold and are stamped and formed from sheet metal stripes such as BeCu or other copper alloys.

3. The elasto-plastic socket of claim 2, wherein the contact surface portion has a concave spherical surface for a BGA package.

4. The elasto-plastic socket of claim 2 or claim 3, wherein the PCB side contact portion is replaced by attaching solder ball for surface mount on the PCB.

5. The application of elasto-plasticity theory to the design of the metal contacts, as claimed in claims 1, 2, or 3, wherein a ductile material is used to define the upper bound of the contact force for each contact in the socket because the curved plate spring is designed to load to a plastic hardening stage and wherein the application will induce to a uniform distribution of the force supporting the bottom of a LGA/BGA package and allow large elasto-plastic deflection of the top surface portion of the metal contacts to accommodate all tolerances in vertical direction.

6. An improved semiconductor flip chip package comprising:

a substrate;

a semiconductor chip mounted on the substrate; and

a thin layer of heat spreader having a very high in-plane or isotropic thermal conductivity adhered to a top side of the semiconductor chip spreading heat from hot spots in junction layer.

7. An elasto-plastic stiffener for an integrated circuit (IC) package using a Land/Ball Grid Array interconnect, the stiffener frame with single or multiple window openings for semiconductor chips or other electrical components comprising:

a top plate;

a bottom plate having retaining means for retaining positioning of the stiffener to the IC package substrate; and

a serpentine shaped supporting structure sandwiched between the top and bottom plates wherein the serpentine shaped supporting structure allows for large deformation in thickness of the stiffener while supporting desired pressure;

8. The elasto-plastic stiffener of claim 7 wherein the stiffener is formed of a single piece or multiple pieces of sheet metal.

9. The elasto-plastic stiffener of claim 7 wherein the serpentine shaped support structure is a wave shaped structure perpendicular to top and bottom plates.

10. The elasto-plastic stiffener of claim 9 wherein the serpentine shaped support structure is slanted toward inside to the semiconductor of an IC package or leaned outside.

11. The application of elasto-plasticity theory to the design of the stiffener as claimed in claims 7, 8, 9, or 10, wherein a ductile material is used to define the upper bound of the contact force of the stiffener and wherein the application of the theory can make it possible to precisely define the pressure on semiconductor chip.

12. An improved Land/Ball Grid Array (L/BGA) integrated circuit subsystem comprising:

a bolster plate;

a printed circuit board (PCB);

a L/BGA socket mounted on the PCB, or direct contact with the PCB pads;

a Land or Ball Grid Array package aligned with the L/BGA socket;

a frame surrounding the L/BGA socket and package,

a heat sink or a heat transfer device placed above the package and the frame,

wherein the PCB is sandwiched between the bolster plate and the frame using multiple screws or fasteners and wherein the frame provides increased stiffness to the subsystem, and wherein the subsystem is secured with screws or fasteners through the heat sink or heat transfer device, the frame, the PCB and the bolster plate, such that the top of the IC package have tight contact with the bottom of heat sink.

13. The subsystem assembly of claim 12 wherein the elasto-plastic stiffener of claim 7 is applied on top of the L/BGA package substrate to share the pressure from semiconductor to package substrate.

14. The subsystem of claim 13 wherein the semiconductor chip package is lidded package with a small size lid or lidless package, or the package of claim 6.

15. A method of assembling a Land/Ball Grid Array (L/BGA) integrated circuit subsystem comprising steps of:

providing a bolster plate;

sandwiching a PCB between a frame and the bolster plate with screws or fasteners;

surface mounting a L/BGA socket on the PCB, or aligning a L/BGA socket with PCB pads for direct contact;

aligning a semiconductor chip package with a L/BGA socket;

mating the bottom of a heat sink or heat transfer device with the top of the frame; and

securing the subsystem with multiple screws or fasteners through the heat sink, the frame, the PCB and the bolster plate.

16. The method claim 15 further comprising placing the elasto-plastic stiffener of claim 7 on top of the IC package substrate, and wherein the semiconductor chip package can be lidless, or lidded with a small size lid or the package of claim 6.

17. The method of claim 15 wherein the frame and the base plate sandwich the PCB loosely with multiple screws or fasteners after solder paste printing, and the L/BGA socket is then surface mounted to the PCB by applying a solder reflow process such that the co-planarity of the socket mounted on PCB can be under controlled.

18. The method of claim 15, wherein the L/BGA socket comprises the elasto-plastic socket of claims 1, 2, 3 or 4.

19. The method of claim 15 further comprising a post forming process wherein a tool with the semiconductor package profile is used to apply pressure to the L/BGA socket of any type after it is surface mounted on the PCB or direct contact with PCB pads by pressure, so that all tolerances due to PCB, socket and frame are eliminated by the plastic deformation of the metal contacts on the socket.

20. The method of claim 19 further comprising a post age hardening process performed after the post forming process, wherein the post age hardening process comprises putting the L/BGA socket, which is contained in the vacuumed high temperature bags to protect the gold plating, in an oven at below solder reflow temperature for few hours to increase the mechanical strength, so that the metal contacts of the L/BGA sockets will exhibit linear elastic properties within larger mechanical strength so to increase the fatigue life.